Space Weather Technical Forecast

Issued on Tuesday 25 March 2025 at 01:18 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1/Minor geomagnetic storms throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low in the past 24 hours, with occasional C-flares. Five sunspot regions now cover the Earth facing solar disc, all of which are magnetically simple. AR4036, approaching the northwest limb, remains the largest group. Recent growth in the leading portion and fading to the rear, with a reclassification, now possessing a large leader. A new spot has emerged around the northeast limb, this appears to have numerous spots and is small to moderate in size.

No Earth-directed CMEs were observed leaving the Sun during the period.

Solar Wind / Geomagnetic Activity: Solar wind parameters, as measured by DSCOVR at L1, were indicative of early CME effects before fading back to generally background. Solar wind speeds became slightly elevated, peaking around 430 km/s before falling back to slow/ambient, ending around 380 km/s. Density became above average, peaking around 35ppcc at 0440UTC before gradually falling back to around average. Interplanetary Magnetic Field, Bt, peaked at strong levels, reaching 17nT at 24/0114 UTC, before gradually falling back to weak. The north-south component, Bz, was Moderate, ranging +13/-10nT before falling back to weak. Phi angle was mostly negative (towards the sun). Geomagnetic activity was at Quiet to Active levels (Kp2-4).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 was at background levels. High energy electron flux (greater than 2 MeV) was at background to moderate levels. The 24-hour fluence was below the Active threshold. The observed integrated pfu was 3.77e6 at 25/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Generally Low solar activity is expected, with a slight chance of isolated M-class flares over the next four days of the guidance period.

Solar Wind / Geomagnetic Activity: One very low confidence CME may arrive early in the period. Otherwise, solar winds are expected to continue at slow-ambient levels to start before probably becoming elevated to strong levels with the expected (most probably gradual) arrival of a HSS from CH25/+ from later day 1 (25 Mar), lasting through day 2 into day 3 (26-27 Mar), then gradually easing day 4 (28 Mar).

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Quiet conditions initially will probably become Unsettled to Active (Kp3-4), with an increasing Chance of G1-G2/Minor-Moderate storms (Kp5-6) due to CH HSS influences, peaking day 2 or day 3 (26/27 Mar) before easing day 4 (28 Mar).

Energetic Particles / Solar Radiation: High energy proton flux is expected to be at background levels, with a slight chance of enhancement from any larger flares. High energy electron flux is expected to continue at largely background to moderate levels until later in the period, when it may become diurnally high. Electron (1e8 integrated pfu) fluence should remain below the Active threshold throughout the period.

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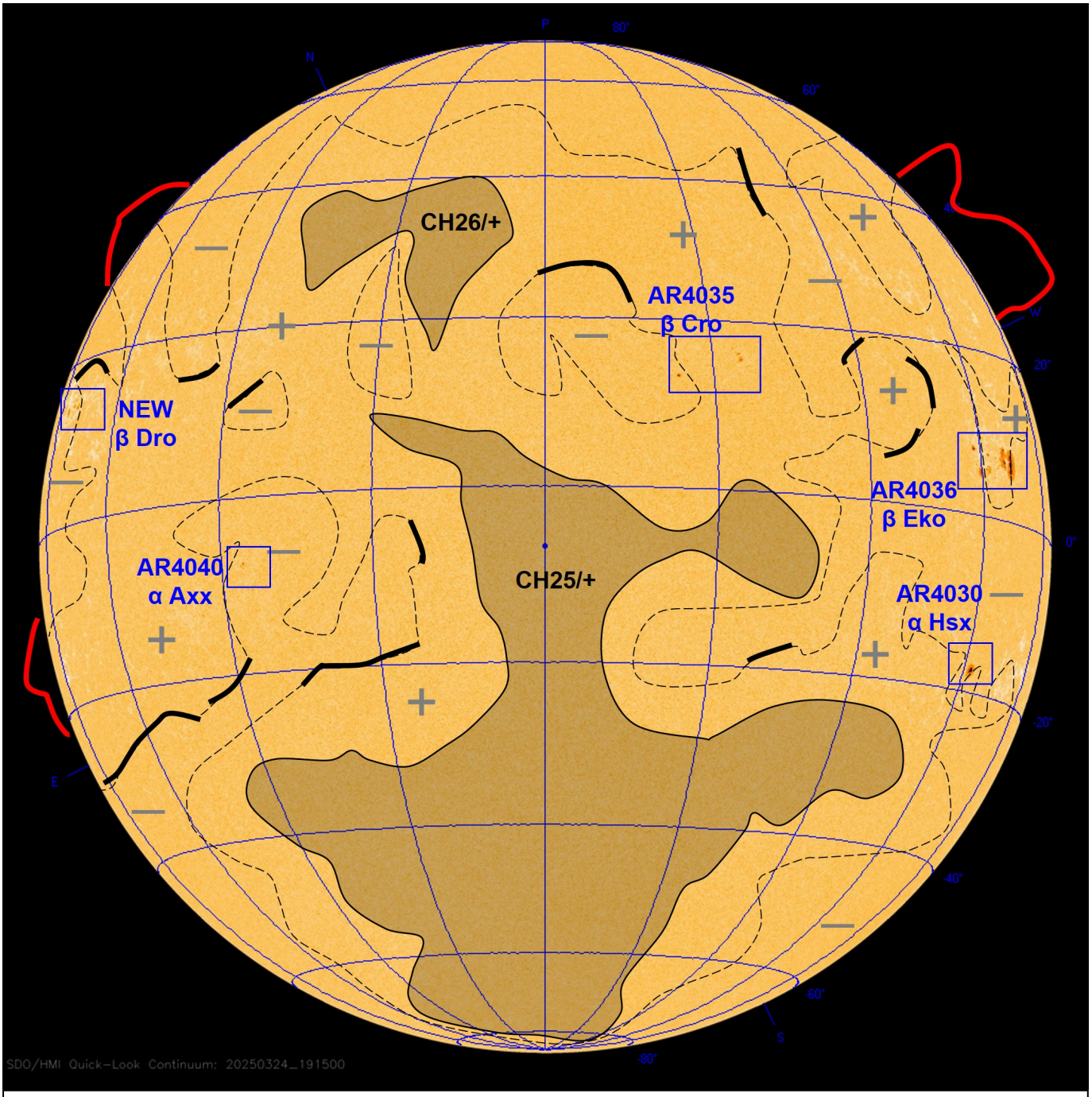
Figure 1: MOSWOC Solar Synoptic Map Valid 23/1915UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

A CME, originating around 22/1400 UTC, may be associated with a small filament eruption near centre disk and was also at a similar time to two northern directed CMEs. Given the lack of STEREO-A imagery and the ability to triangulate this CME, it is not known for definite if this is a near or far-sided feature. It was expected to arrive on 24 Mar so is now considered late/a miss/far sided, therefore there is very low confidence in this CME arriving early in the period.

Solar winds are expected to continue at slow-ambient levels to start before probably becoming enhanced, reaching elevated to strong levels with the expected (most probably gradual) arrival of a HSS from the unusually prominent coronal hole feature CH25/+ from later day 1 (25 Mar), lasting through day 2 into day 3 (26-27 Mar), then gradually easing day 4 (28 Mar). During the previous rotation solar winds exceeded 700 km/s for a time. SWPM is likely providing good guidance on potential wind speeds through the period given a similar structure to this coronal hole was observed on last rotation.

Quiet conditions initially will probably become Unsettled to Active (Kp3-4), with an increasing Chance of G1-G2/Minor-Moderate storms due to CH HSS influences, peaking day 2 or day 3 (26/27 Mar) before easing day 4 (28 Mar).

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	50	50	30
Strong	G3	No	1	5	5	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R⊙ (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed (km/s)	Estimated Arrival Time (UTC)	Comments
22/1810	Partial	Filament	Centre (possibly far-side)	1000	24/1200	Low confidence on lift off and lack of STEREO imagery so could be far-sided.

Figure 2: MOSWOC ENLIL

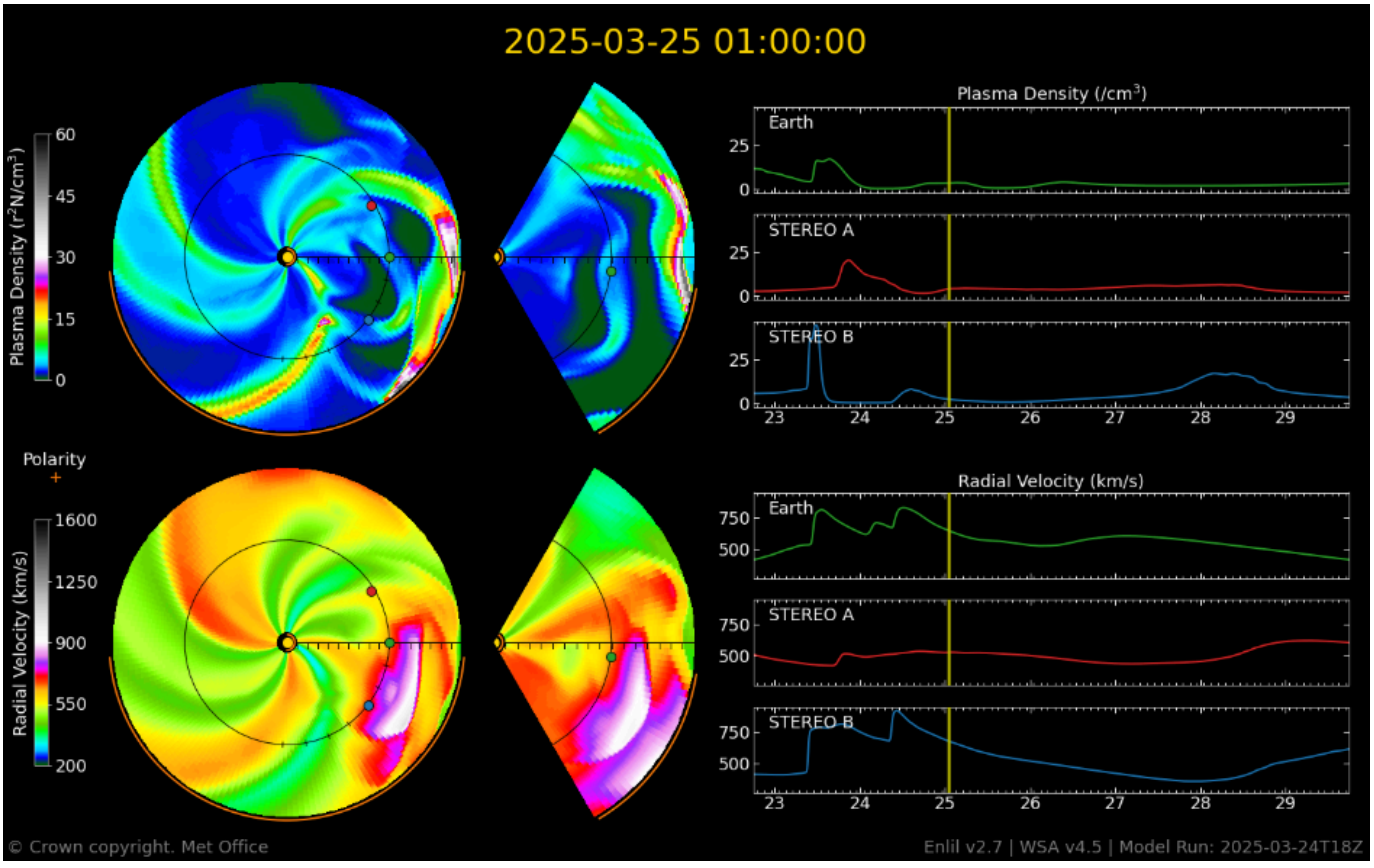

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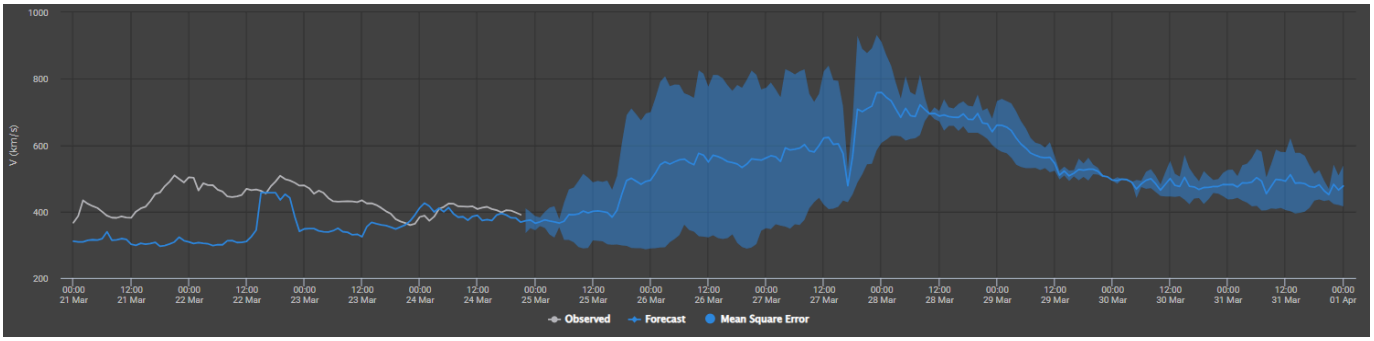
Figure 3: MOSWOC SWPM showing guidance on wind speeds in relation to previous rotation.



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Radio Blackouts - X-Ray Flares

Solar activity has been Low in the past 24 hours, with occasional C-flares. The largest flare from AR4035 reaching C5.2 at 24/0737 UTC.

Five sunspot regions now cover the Earth facing solar disc, all of which are magnetically simple. AR4036, approaching the northwest limb, remains the largest group. Recent growth in the leading portion and fading to the rear, with a reclassification, now possessing a large leader. AR4039 and AR4042 in the east have now faded. A new spot has emerged around the northeast limb, this appears to have numerous spots and is small to moderate in size, a further analysis will be necessary as it rotates into a more Earth-facing view. All other spots are small and simple.

Low activity is expected to continue, with a slight chance of isolated M-class flares. The greatest risk probably coming from AR4036 in the northwest, however this will rotate to the far side during this guidance period.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	No	20	20	15	15
Very Active	R3-R5 (X Class)	No	1	1	1	1

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Figure 4: 24 hour X-ray flux

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Solar Radiation Storms (High Energy Protons)

GOES18 high energy (>10MeV) proton flux was at background levels. Proton flux is expected to remain at background levels, with only a slight chance of enhancement due to the current lack of large, complex spot groups on the Earth facing disc, with a reducing trend with time due to AR4036 rotating around the western limb.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	3	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons (≥ 2MeV)

GOES16 High energy (>2MeV) Electron flux has been at background to moderate levels. With CH HSS influences expected through the period, flux levels are likely to remain background to moderate, perhaps briefly diurnally high at times.

Electron (1e8 integrated pfu) fluence should remain below the Active threshold throughout the period. MOSWOC REFM shows the electron fluence should remain below the Active threshold throughout the period, and is considered reasonable guidance with moderate confidence currently.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	5	5
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 5: 24 hour electron flux (top). MOSWOC REFM fluence forecast/observations/recurrence (bottom).

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